in formal respects to improve the wording thereof. New claims 115-119 have been added to cover the subject matter of original multiple dependent claims 23/20-21 and 24/20-21.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached pages i-xvi are captioned **"VERSION WITH MARKINGS TO SHOW CHANGES MADE."**

Early and favorable action on the merits are most respectfully requested.

Respectfully submitted,

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MAILING CERTIFICATE

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: Commissioner of Patents & Trademarks, Washington, D.C. 20231, on the date indicated below.

Bruce L. Adams
Attorney Name

_____
Signature

JULY 11, 2001
Date

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Heading beginning at line 22 of page 7 has been amended as follows:

[DISCLOSURE] SUMMARY OF THE INVENTION

Heading beginning at line 10 of page 49 has been amended as follows:

[BEST MODE FOR CARRYING OUT THE INVENTION] DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Paragraph beginning at line 3 of page 85 has been amended as follows:

Otherwise, the near-field light localized at a sample surface is scattered by the protrusion 2102 at the tip of the optical waveguide 2103 and derived as propagation light and then introduced at a rear of a light introducing end 2105 to a detector. This can also detect optical information on a very small area collection [mode)] mode. In also this case, because the region that the optical waveguide width in the protrusion 2102 at the tip of the optical waveguide 2103 is smaller than a light wavelength of light is structured fully narrow, the greater part of near-field light can be scattered

into propagation light and be guided with reduced propagation loss to the light introducing end by the light reflection layer 2104.

Paragraph beginning at line 7 of page 101 has been amended as follows:

Next, a manufacturing method for a near-field optical head 2500 according to Embodiment [1] 9 described above will be explained with reference to Fig. 26(a) to Fig. 26(f). First, in Fig. 26(a) a clad 2502 is deposited on a surface of a silicon substrate 10 by the technique of CVD, sputtering, evaporation or the like stated before such that a thin film of silicon dioxide becomes a thickness of 200 nm - 50 μm. Then, a photolithography technique is used to form a taper hole 2502a in the clad 2502.

IN THE CLAIMS:

Claims 1-8, 9-14 20-32, 38 and 80-84 have been amended as follows:

1. (Amended) A [In a] near-field optical head [having a very small aperture for producing or scattering near field light, a near-field optical head characterized by] comprising:

a planar substrate having a first surface, a second surface disposed opposite to the first surface, and [formed penetrating through with] an inverted conical or pyramidal hole extending through the first and second surfaces and having at least one fine [having an apex thereof made as the very small] aperture formed at an apex thereof and disposed on the first surface;

an optical waveguide disposed on the second surface of the planar substrate for propagating light [formed on a surface opposite to a surface forming the very small aperture]; and

a light reflection film disposed [formed] in the optical waveguide for reflecting in the direction of the fine aperture light propagated through the optical waveguide [to bend an optical path].

2. (Amended) A near-field [near field] optical head according to claim 1[,]; wherein the optical waveguide is disposed [also formed at an] inside of the inverted conical or pyramidal hole.

3. (Amended) A near-field [near field] optical head according to claims [claim] 1 or 2[,]; wherein the inverted conical or pyramidal hole comprises [is formed by] a plurality of slant surfaces each having a different degree of [in] slant from the other [degree].

4. (Amended) A near-field [near field] optical head according to claim 3[,]; wherein one of the [in the plurality of] slant surfaces has a degree of [a] slant [surface having a slant degree] smaller than a mean [slant] degree of slant of the plurality of slant surfaces and is disposed [exists] in a vicinity of the [very small] fine aperture.

5. (Amended) A near-field [near field] optical head according to claim 3[,]; wherein [in the plurality of slant surfaces] at least one of the slant surfaces [surface] has an angle of inclination smaller than 55 degrees with respect to a [the] surface forming the fine [very small] aperture.

6. (Amended) A near-field [near field] optical head according to claims 1 or 2; [either one of claim 1 or claim 2,] wherein the inverted conical or pyramidal hole of the planar substrate has at least one [of] curved slant surface [in a curved surface form].

7. (Amended) A near-field [near field] optical head according to claim [6, wherein, a vicinity of the very small aperture, at least one of the slant surface in a] 6; wherein the curved slant surface [form] decreases in slant degree toward [as] the fine aperture [is approached].

8. (Amended) A [near field] near-field optical head according to [any one of claim 1 to] claim 7[,]; wherein the light reflection film or the optical waveguide [has a focusing function] focuses light to the [very small] fine aperture or [a] collimates light [collimating function] from the [very small] fine aperture.

9. (Amended) A near-field [near field] optical head according to [any one of claim 1 to claim 8,] claim 8; wherein the optical waveguide comprises a core and [is structured by a combination of] a clad disposed over the [and a] core.

10. (Amended) A near-field [near field] optical head according to [any one of claim 1 to claim 9,] claim 9; wherein the at least one fine aperture comprises [planar substrate has] a plurality of fine apertures; and wherein [the very small apertures,] the optical waveguide and the light reflection film [being formed to] guide light generated from at least one [of] light source to the plurality of [very small] fine apertures.

11. (Amended) A method of [In] manufacturing a near-field optical head, comprising the steps of: [having]

providing a planar substrate having a first surface and a second surface opposite the first surface;

forming through the first surface of the [a] planar substrate [formed penetrating through with] an inverted conical or pyramidal hole having a fine aperture at [having] an apex thereof [made as the very small aperture];

forming an optical waveguide [formed] on the second [a] surface of the planar substrate for propagating light [opposite to a surface forming the very small aperture]; and

forming a light reflection film [formed] in the optical waveguide for reflecting light propagated through the optical waveguide. [to bend an optical path, a method for manufacturing a near field optical head characterized in that:

the optical waveguide is formed laid on the planar substrate.]

12. (Amended) A method of [In] manufacturing a near-field optical head, comprising the steps of: [having]

providing a planar substrate having a first surface and a second surface opposite the first surface;

forming through the first surface of the [a] planar substrate [formed penetrating through with] an inverted conical or pyramidal hole having a fine aperture at [having] an apex thereof; [made as the very small aperture,]

bonding an optical waveguide [formed] on the second [a] surface of the planar substrate for propagating light; [opposite to a surface forming the very small aperture,] and

forming a light reflection film [formed] in the optical waveguide for reflecting light propagated through the optical waveguide. [to bend an optical path, a method for manufacturing a near field optical head characterized in that:

the optical waveguide is formed bonded on the planar substrate.]

13. (Amended) A [In a] method for manufacturing a near-field optical head, comprising the steps of: [having a very small aperture for producing or scattering near field light, a method for manufacturing a near field optical head characterized by including:]

providing a planar substrate having a first surface and a second surface opposite the first surface;

[a process of] forming through the first surface of the planar substrate an inverted conical or pyramidal hole [penetrating through the planar substrate] having a fine aperture at [to have] an apex thereof for scattering near field light [made as the very small aperture];

disposing [a process of laying] an optical waveguide on the second [a] surface of the planar substrate for propagating light [opposite to a surface forming the very small aperture]; and

[a process of] forming a light reflection film in the optical waveguide for reflecting light propagated through the optical waveguide [in a manner bending an optical path].

14. (Amended) [In a] A method for manufacturing a near-field optical head, comprising the steps of: [having a very small aperture for producing or scattering near field light, a method for manufacturing a near field optical head characterized by including:]

providing a planar substrate having a first surface and a second surface opposite the first surface;

[a process of] forming through the first surface of the planar substrate an inverted conical or pyramidal hole having a fine aperture at [penetrating through the planar substrate to have] an apex thereof for scattering near field light [made as the very small aperture];

[a process of] bonding [and forming] an optical waveguide on the second [a] surface of the planar substrate for propagating light; and [opposite to a surface forming the very small aperture];

[a process of] forming a light reflection film in the optical waveguide for reflecting light propagated through the optical waveguide [in a manner bending an optical path].

20. (Amended) A near-field optical head [characterized by] comprising:

a planar substrate having a first surface, a second surface disposed opposite the first surface, and [formed through with] an inverted conical or pyramidal hole extending

through the first and second surfaces and having a fine aperture formed at [to have] an apex thereof and disposed on the first surface [made as a very small aperture]; and

an optical waveguide disposed on the second [laid on an opposite] surface of the planar substrate [to a surface forming the very small aperture] and on an an inner surface [inside] of the inverted conical or pyramidal hole, the optical waveguide having a sharpened microscopic tip protruding from the fine aperture of the inverted conical or pyramidal hole.[; and

a tip sharpened microscopic protrusion formed by one part of the optical waveguide and protruding from the very small aperture of the planar substrate.]

21. (Amended) A near-field optical head according to claim 20[, wherein in an area except for the protrusion]; further comprising a light reflection layer for reflecting light [is] and formed on a periphery of the optical waveguide except for the sharpened microscopic tip.

22. (Amended) A near-field optical head according to claims 20 or 21; [claim 20 or claim 21,] wherein the sharpened microscopic tip has a generally [protrusion is in an] square pyramid shape [form].

23. (Amended) A near-field optical head according to claim 22; [any one of claim 20 to claim 22,] wherein the inverted conical or pyramid hole has [is formed by] a plurality of slant surfaces each having a different [in] degree of slant from the others [degree].

24. (Amended) A near-field optical head according to claim 23; [any one of claims 20 to 23,] wherein the optical waveguide comprises [is formed by] a core and a clad disposed over the core.

25. (Amended) A near-field optical head according to claim 24; [any one of claims 20 to 24,] wherein the planar substrate has a plurality of fine [very small] apertures[,]; and wherein the optical waveguide and the light reflection layer [being formed to] guide light emitted from at least one light source toward the plurality of [very small] fine apertures.

26. (Amended) A method for manufacturing a [near field] near-field optical head, comprising the steps of: [characterized by including:]

providing a planar substrate having a first surface and a second surface opposite the first surface;

[a process of] forming an inverted conical or pyramidal hole through the first surface of the [in a] planar substrate;

disposing [a process of laying] an optical waveguide on the planar substrate and on an inner surface [including an inside] of the inverted conical or pyramidal hole;

[a process of] forming a microscopic protrusion on the second surface [an opposite surface] of the planar substrate [of the inverted conical or pyramidal hole]; and

[a process of] forming a light reflecting layer in the optical waveguide for reflecting light propagated through the optical waveguide [in a manner bending an optical path].

27. (Amended) A method for [In] manufacturing a [near field] near-field optical head, comprising the steps of:

providing a planar substrate having a first surface and a second surface opposite the first surface;

forming through the first surface of the [a] planar substrate [formed through with] an inverted conical or pyramidal hole having a fine aperture at [to have] an apex thereof [made as a very small aperture]; and

disposing an optical waveguide [laid] on the second [an opposite] surface of the planar substrate [to a surface forming the very small aperture] and on an inner surface [inside] of the inverted conical or pyramidal hole so that a sharpened microscopic tip of the optical waveguide protrudes from the fine aperture of the inverted conical or pyramidal hole. [;

a tip sharpened microscopic protrusion formed by one part of the optical waveguide and protruding from the very small aperture of the planar substrate, a method for manufacturing a near field optical head characterized in that:

the optical waveguide and the light reflection layer are formed by laying on the planar substrate.]

28. (Amended) A [In a] near-field optical head comprising: [for recording and/or reading-out information of a recording media utilizing near field light, a near field optical head characterized by comprising:]

an optical waveguide comprised of [comprising] a first clad having [formed through with] at least one inverted conical or pyramidal hole extending therethrough and having a fine aperture at [to have] an apex thereof, [made as a very small aperture,] a core [formed in a depth direction] extending along a side surface of the inverted conical or pyramidal hole, and a second clad disposed over the core so that the core is disposed between the first and second clads [formed in a manner cooperating with the first clad to clamp the core]; and

a first reflection film disposed on an [formed on one] end surface of the optical waveguide.

29. (Amended) A near-field optical head according to claim 28[,]; further comprising a second reflection film disposed on a rear surface [formed on an backside] of the first clad and having a microscopic diameter hole disposed in a position corresponding to the fine [very small] aperture.

30. (Amended) A near-field optical head according to claims [claim] 28 or 29[,]; wherein the [one] end surface of the optical waveguide is [made in a] curved [surface].

31. (Amended) A [In a] near-field optical head [for recording and/or reading-out information of a recording media utilizing near field light, a near field optical head characterized by] comprising:

an optical waveguide comprised of [comprising] a clad having [formed through with] at least one inverted conical or pyramidal hole extending therethrough and having a fine aperture at [to have] an apex thereof [made as a very small aperture], and a core extending [formed in a depth direction] along a side surface of the inverted conical or pyramidal hole;

a reflection film disposed on an [formed on one] end surface of the optical waveguide; and

a substrate bonded on the core of the optical waveguide and having a refractivity different from that [a refractivity] of the core.

32. (Amended) A [In a] method for manufacturing a near-field optical head, comprising the steps of: [for recording and/or reading-out information to and from recording medium utilizing near field light, a method for manufacturing a near field optical head characterized by comprising:]

providing a substrate;

[a first process of] forming a first clad on the [a] substrate;

[a second process of] forming in the first clad at least one inverted conical or pyramidal hole having a fine aperture at [such that] an apex thereof [is made as a very small aperture];

[a third process of] forming a core in a depth direction along the first clad and a [the] side surface of the inverted conical or pyramidal hole;

[a fourth process of] forming a second clad over the core so that the core is disposed between the first and second clads to form an optical waveguide comprised of the core and the first and second clads [in a manner of cooperating with the first clad to clamp the core];

[a fifth process of] forming a reflection film on one end surface of the [an] optical waveguide formed [by the first clad, the core and the second clad]; and

[a sixth process of] removing the substrate.

38. (Amended) A near-field optical head as in any one of claims 33-37; [according to any one of claim 33 to claim 37,] wherein the taper is asymmetric [in shape] about a center axis of the taper passing through the apex.

80. (Amended) A near-field optical head as in any one of claims 76-79; [according to any one of claim 76 to claim 79,] wherein at least one part of the focus functioning member [in at least one part] is comprised of a dielectric material.

81. (Amended) A near-field optical head as in any one of claims 76-79; [according to any one of claim 76 to claim 79,] wherein the focus functioning member has a vertical surface extending in [to] a light propagation direction, the vertical surface having at least one convex portion [part made in convex form].

82. (Amended) A near-field optical head according to claim 81[,]; wherein the focus functioning member is generally spherical-shaped [spherical].

83. (Amended) A near-field optical head as in any one of claims 76-79; [according to any one of claim 76 to claim 79,] wherein at least one part of the focus functioning member [in at least one part] has a refractive gradient [having a refractivity different] which is variable stepwise.

84. (Amended) A near-field optical head as in any one of claims 76-79; [according to any one of claim 76 to claim 79,] wherein at least one part of the focus functioning member [in at least one part] has a grating structure.